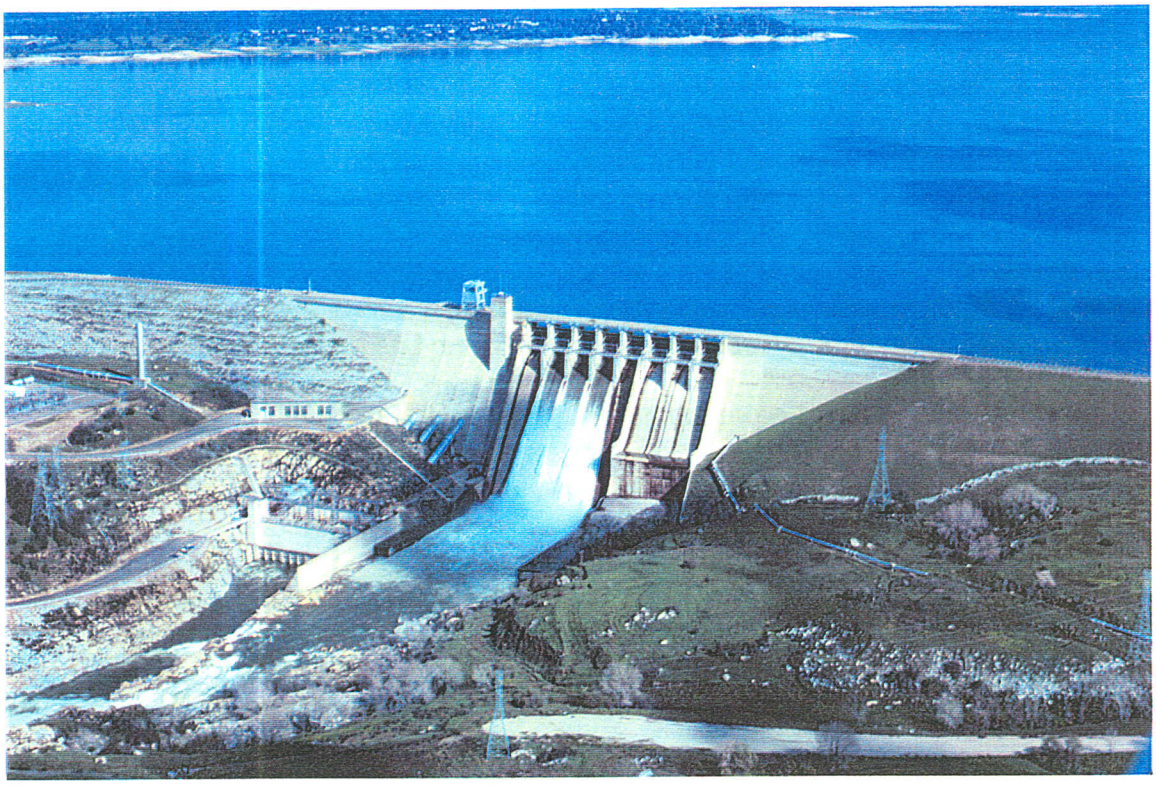
US Army Corps of Engineers
Sacramento District

Sacramento Area Flood Control Agency

Folsom Joint Federal Project

Engineering Status Report



June 2006

INTRODUCTION

The limitations of the existing flood control system in the Sacramento area and the urgent need to increase the level of flood protection have received heightened public attention in the aftermath of the 2005 Gulf Coast hurricanes. With this added sense of urgency and in an increasingly costly construction market, the U.S. Army Corps of Engineers (USACE), U.S. Department of the Interior, Bureau of Reclamation (Reclamation), Sacramento Area Flood Control Agency, State of California Department of Water Resources, and State of California Reclamation Board seek to integrate the planning, design, and implementation of enhanced flood protection measures with dam safety risk reduction under a single Joint Federal Project at the Folsom Dam and Reservoir (Folsom Facility).

In June 2005, USACE estimated the standalone Outlet Modifications and Dam Raise projects (including a Probable Maximum Flood (PMF) spillway) to have a first cost of $1,729,000,000 with total project benefits provided by 2023. Due to the escalating costs of completing (USACE flood control and Reclamation dam safety) individual projects the partner agencies committed to a joint value planning process referred to as the Project Alternative Solutions Study (PASS I) was conducted from September through October 2005 and considered five alternatives for a Joint Federal Project that would exceed or meet the individual project objectives. Upon identifying the most promising of these alternatives, PASS II was commissioned in November 2005 to provide further scoping and design analysis of a gated auxiliary spillway and to generate an appraisal-level cost estimate that takes into account current market conditions and other factors significantly affecting project costs within the region. The PASS II Alternative identified a technically feasible plan for the Joint Federal Project having a preliminary cost estimate of $1,514,000,000 and providing total project benefits by 2017. The PASS II effort was completed in April 2006 and is currently undergoing a rigorous optimization review and preparation of feasibility level cost estimates for budgetary and project approval purposes.

Ongoing design optimization and refinement of project features and costs will, when completed, provide the basis of design and implementation for a Joint Federal Project. PASS II Optimization described below is expected to meet or exceed the minimum design objectives at a significantly lower overall cost than the PASS II Alternative. Preliminary, appraisal-level cost estimates put PASS II Optimization at $1,193,000,000 with total project benefits provided by 2014. Based in large part on the results of PASS II Optimization, USACE and Reclamation will complete the required decision and environmental compliance documents that together will constitute the Joint Federal Project. Details of the PASS study process and phases are covered in following sections.

PURPOSE OF STATUS REPORT

The purpose of this Engineering Status Report is to provide an update on efforts to develop and approve the Joint Federal Project. This status report represents a snapshot in time of the combined efforts of USACE, Reclamation, and the non-Federal project sponsors to incorporate the results of these studies into the respective agency decision and environmental compliance documents while also describing the proposed Joint Federal Project.

JOINT FEDERAL PROJECT OBJECTIVES

The goal of the PASS II report and subsequent optimization is to expedite development and approval by Reclamation and USACE of a Joint Federal Project that effectively achieves the following performance objectives:

- Provide 200-year or better flood protection.
- Address the dam safety hydrologic risk by passing the probable maximum flood (PMF).

The report also presents additional dam safety elements that may be either incorporated into or constructed concurrently with the Joint Federal Project to expeditiously comply with Reclamation's Public Protection Guidelines. Because of the magnitude of risks posed to public safety and property by delaying action, both the flood damage reduction and dam safety risk reduction projects at the Folsom Facility must be implemented expeditiously regardless of other flood damage reduction proposals being considered for the region.

It is therefore USACE and Reclamation's objective, by integrating and streamlining planning, design, and construction efforts, to develop a Joint Federal Project that achieves the above flood protection and dam safety objectives at a significantly reduced cost over separate, individually implemented agency projects and to provide the project benefits to the public sooner.

JOINT FEDERAL PROJECT OVERVIEW

The PASS II Alternative includes modifications to the following main components of the Folsom Facility that serve both flood control and dam safety risk reduction purposes. Figure 1 provides an overview of these features:

- Construction of a new gated Auxiliary Spillway on the left abutment. This includes a 90' wide lined auxiliary spillway with four new 17.5' by 33' submerged tainter gates.
- 7-foot Embankment Raise of all earthen embankments (Mormon Island Auxiliary Dam, Right and Left Wing Dams, and Dikes 1 through 8) around the rim of the reservoir to complement flood and PMF protection provided by the spillway with additional filter, drain and overlay elements to provide improved risk reduction from potential seepage and seismic events; and,
- 7-foot raise of the Main Concrete Dam with modifications to the existing spillway and outlet gates to complement flood and PMF protection provided by the auxiliary spillway and embankment raise with additional elements securing the concrete dam foundation from potential seismic events.

In addition to the features included in the PASS II Alternative, there are several related projects being pursued by the respective partner agencies concurrent with the Joint Federal Project. These projects include Folsom Bridge, Mormon Island Auxiliary Dam foundation improvements, and ecosystem restoration efforts.

PROJECT ALTERNATIVE SOLUTION STUDIES

To initiate development of the Joint Federal Project, USACE and Reclamation adopted a collaborative value planning approach that was conducted in three stages as follows:

Stage 1: PASS I. The PASS I study was conducted in September and October 2005 with the purpose of developing flood control and dam safety risk reduction alternatives for the Folsom Facility. This study considered a broad range of alternatives that were quickly synthesized into a select group of alternatives, each satisfying the above stated objectives. Each alternative also included some variation of an auxiliary spillway and a dam raise and some modification of the existing concrete dam. Concept-level cost estimates were prepared for each alternative for comparative purposes. Alternative Delta, consisting of an auxiliary spillway with four submerged tainter gates and a 7-foot dam raise, was shown to have the least apparent relative cost of the alternatives considered.

Stage 2: PASS II. The PASS II study effort commenced in November 2005 with the primary objectives of further assessing the hydraulic performance of Alternative Delta for flood control and dam safety and obtaining an appraisal-level cost estimate. The study further defined the project features, assessed technical feasibility, developed an overall program schedule, and established an appraisal-level opinion of probable project cost. In summary, the PASS II report presents a technically feasible Joint Federal Project that meets and exceeds the flood protection and dam safety objectives at the Folsom Facility at a considerable savings over implementation of separate, independently implemented agency projects to achieve the same objectives.

The auxiliary spillway component (Figure 1) of the PASS II Alternative consists of a concrete control structure housing four submerged tainter gates, a rectangular chute downstream from the new control structure, and a concrete-lined stilling basin to serve as an energy dissipater.

Hydrology evaluations were performed, including the routing of several design floods up to the Probable Maximum Flood (PMF) through the existing dam spillway and the proposed auxiliary spillway to determine the resulting level of flood protection provided downstream. The minimum performance objectives were: (1) to limit outflows from Folsom Dam for the 200-Year Design Flood to the downstream channel capacity of 160,000 cubic feet per second (cfs); and, (2) to pass the PMF through Folsom Dam with at least 3 feet of freeboard.

The PASS II Alternative meets these objectives by controlling the 200-year design flood to a maximum outflow of 160,000 cfs with a maximum lake elevation of 470.1 feet. The project top of dam is at elevation 487.5 feet. Therefore, over 17 feet of freeboard exists for the 200-year design flood. The 250-year design flood is also controlled to 160,000 cfs with a maximum lake elevation of 479 feet (over 8 feet of freeboard). Consequently, the PASS II Alternative significantly exceeds the minimum flood control objective and contains the PMF to elevation 484.1 feet (more than 3 feet below the top dam elevation of 487.5 feet).

The cost estimate prepared for the PASS II report is considered an appraisal-level estimate, based on limited information and subject to a wide accuracy range and is intended for determining basic design feasibility and project screening. The estimate was independently prepared for USACE and Reclamation based on quantities and project execution schedules provided by the Study Team. The first cost of the auxiliary spillway structure and the associated embankment modifications is currently estimated at $1,514,000,000 including all construction, program costs, and design. The estimated total program cost, including a 3% contingency allowance for escalation and a 2.1% mandated escalation rate, is $1,700,000,000.

Stage 3: PASS II Optimization. Opportunities to meet or exceed the level of flood protection above the minimum 200-year level, while reducing costs, are currently being explored in a refinement of the PASS II Alternative. The objective of PASS II Optimization is to maximize the benefits provided by the auxiliary spillway, minimize the amount of physical raise to the facility impoundment features (dikes and dam), and update the incorporation of dam safety features. It appears that minimizing the raise will result in a significant reduction of cost and earlier implementation of the increased flood control and dam safety components with a minimal decrease in flood control from the 7-foot raise. Efforts of this third phase are currently underway with preliminary results provided within this status report.

The Pass II Optimized consists of two basic parts. "Base Optimization" consists of an auxiliary structure with 6 submerged tainter gates, 23 feet wide by 33 feet tall with the sill elevations at 368 feet. (See Figure 1.) An approach channel will be dredged in the lake following completion of the structure. Releases will be discharged through the auxiliary spillway and a 177-foot, concrete-lined chute into a stilling basin serving as an energy dissipater before merging with spillway and powerhouse releases from the main dam.

Preliminary evaluation indicates that the 6-gate configuration safely passes the PMF. This preliminary result is subject to final agreement on the routing of the PMF through the spillway. Additional evaluation is underway to determine whether the 6-gate configuration will provide 200-year or better flood protection. If not, the following additional features may be added to the Base Optimizations as warranted to increase performance, reduce costs and/or expedite project completion.

- Further enlarge submerged tainter gate size
- Modify/replace existing emergency or service gates
- 3.5' raise of the embankments (parapet wall, replace 3 emergency gates & spillway bridge)
- Further optimize the auxiliary spillway (deeper, wider).

The question to be addressed is whether or not the additional increment performance provided by these additions would be justified by the associated costs and benefits. Further optimization of the auxiliary spillway may also be performed to determine of additional performance can be achieved within the limits of safe design criteria.

Notwithstanding, PASS II Optimized also includes the following dam safety related features:

- Construction of an Interim PMF Spillway on the left abutment to provide interim PMF protection while the flood control design elements are designed, funded, and constructed;

- Incorporation of filter, drain, and overlay elements at select earthen embankments to provide improved risk reduction from potential seepage and seismic events; and,

- Main Concrete Dam reinforcement type modifications to the existing spillway and outlet gates to complement the PMF protection provided by the Auxiliary Spillway; additional seismic reinforcements include the installation of tendons and/or shear keys to further secure the concrete dam foundation.

The first cost of the PASS II Optimization is currently estimated at $1,193,000,000, including all construction, program costs, and design. The fully funded cost – first cost escalated to the midpoint of construction – is approximately $1,357,000,000. It must be emphasized that these are preliminary, appraisal-level cost estimates that will be verified and refined as part of the ongoing optimization efforts.

IMPLEMENTATION

At the outset of the PASS study process, USACE adopted a value engineering approach in response to the escalated project costs of the previous outlet modifications plan and to document the design change to the functionally equivalent Auxiliary Spillway. By using this approach in place of the General Re-evaluation Report that is normally performed for a project change of this magnitude, 2 to 4 years were eliminated from the design schedule.

The Corps decision document that will incorporate the changes of the PASS study efforts, design refinements, and plan formulation requirements (alternatives and economic analyses, environmental compliance, and other documentation) pertaining to the flood damage reduction project at the Folsom Facility will be contained in a Post Authorization Change (PAC) Report and the accompanying joint Reclamation and USACE Environmental Impact Statement. The details of the dam safety risk reduction project at the Folsom Facility will be similarly contained in Reclamation's MOD (Modification of Dam) Report. The USACE and Reclamation decision documents will both describe the proposed Joint Federal Project and the basis for proceeding under that plan.

The development of the PASS II Alternative resulted in additional construction schedule savings of at least three years, completing in 2017 versus the 2021 date projected for completion of the separate USACE and Reclamation projects. Optimization of the Joint Federal Project is expected to yield further schedule savings depending primarily on the final design height and configuration of the Dam Raise.

CONCLUSIONS

The collaboration of local, State, and Federal partners through alternatives analysis and the continuing optimization of the Joint Federal Project have resulted in a plan that achieves the flood control and dam safety objectives at the Folsom Facility at a significantly reduced cost and expedited schedule compared to the separately implemented USACE and Reclamation projects.

The cost savings are realized in a number of ways including the functional integration of flood control and dam safety features and the coordinated planning, design, and construction activities of the partner agencies. Significant additional savings are achieved by reducing the overall schedule by 4 to 9 years and thus reducing the cost escalation that occurs with the passage of time and financing of large, complex public works projects.

In conclusion, the schedule reductions and cost savings realized by the development and optimization of the Joint Federal Project provide the public with the benefits from the much needed flood control and dam safety risk reduction improvements at the Folsom Facility sooner and at a substantially lower cost than provided by the separately implemented projects.

FUTURE ACTIONS

Because the PASS studies and subsequent optimization efforts are part of an ongoing process to verify the technical feasibility of the proposed Joint Federal Project and have thus far resulted in only appraisal-level cost estimates, USACE and Reclamation must still perform detailed cost estimates of the refined Joint Federal Project, the applicable economic studies to verify benefit-to-cost ratios, and complete environmental compliance of the proposed action. The results of these assessments will be provided in the respective USACE flood control and Reclamation dam safety decision documents. Moreover, both decision documents will provide a basis for comparison between the separately implemented agency projects and the relative merits of the Joint Federal Project.

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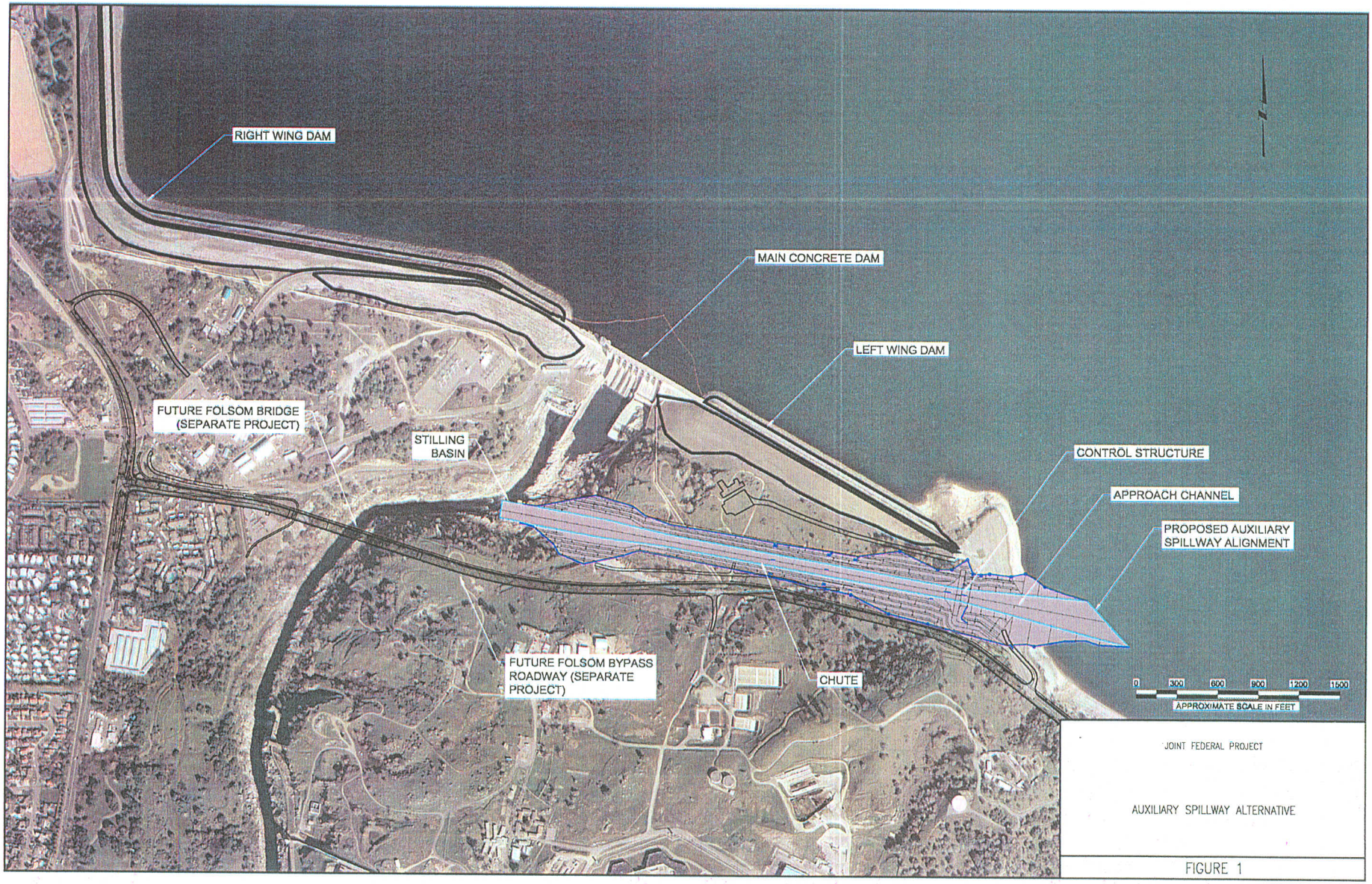
RIGHT WING DAM
MAIN CONCRETE DAM
LEFT WING DAM
FUTURE FOLSOM BRIDGE (SEPARATE PROJECT)
STILLING BASIN
CONTROL STRUCTURE
APPROACH CHANNEL
PROPOSED AUXILIARY SPILLWAY ALIGNMENT
FUTURE FOLSOM BYPASS ROADWAY (SEPARATE PROJECT)
CHUTE
0 300 600 900 1200 1500
APPROXIMATE SCALE IN FEET
JOINT FEDERAL PROJECT
AUXILIARY SPILLWAY ALTERNATIVE

FIGURE 1